Eighth Street Bridge
Spanning the Manitowoc River at Eighth Street
City of Manitowoc
Manitowoc County
Wisconsin

HAER No. WI-78

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Denver, Colorado 80225-0287

HAER
WIS
36-MANI,
1-

HISTORIC AMERICAN ENGINEERING RECORD
EIGHTH STREET BASCULE BRIDGE
CITY OF MANITOWOC, MANITOWOC COUNTY, WISCONSIN
HAER No. WI-78

Location:	Spanning the Manitowoc River at Eighth Street in the city of Manitowoc, Manitowoc County, Wisconsin.
UTM:	South abutment: 16/447395/4882035 North abutment: 16/447395/4882115
Quad:	Manitowoc, Wisconsin (7.5 minute series)
Date of Construction:	1926
Designer:	Klug and Smith, Milwaukee, Wisconsin
Fabricator:	Manitowoc Ship Building Corporation (superstructure); MacMullen and Pitz Construction Company, Manitowoc (substructure)
Present Owner:	None
Present Use:	Demolished in 1994
Significance:	The Eighth Street Bridge—completed in 1926—was typical of the simple-trunnion, fixed counterweight bascule design developed in Milwaukee during the first decade of the twentieth century. The bridge's greatest significance, however, lies in its historical associations with the Manitowoc maritime industry in general and with the Manitowoc Ship Building Corporation in particular.
Project Information:	Documentation of the Eighth Street Bridge was completed by Amy A. Ross, Architectural Historian at Mead & Hunt, Inc., in 1994. This report relies heavily upon Jeffrey A. Hess's Movable Bridges in Wisconsin (Wisconsin Department of Transportation, forthcoming). The bridge description and history, as well as the context for bascules in Wisconsin, derive directly from this text. Applicable footnotes have been reprinted.

History of the Area

The area that was to become Manitowoc County was first created as a separate entity on December 7, 1836, by the Wisconsin Territorial Legislature, which had been established in April of that year. In late 1838, the Legislature authorized a county government; the first elections were held in March of the following year. The county seat was located at Manitowoc Rapids, where it remained until 1853 when it was moved to Manitowoc—a community located on Lake Michigan, only a few miles to the east.[1]

In 1835, Jacob Conroe was the first white settler in the area, establishing a claim at what became Manitowoc Rapids. Chicago merchant and land speculator, Benjamin Jones purchased a large tract at the mouth of the Manitowoc River in 1835 and settled here the next year, becoming the second county settler. In 1836, Conroe, having been joined by 30 men, built a sawmill and established a lumbering concern.[2] Abundant pine timber, excellent water power on the Manitowoc River and emerging markets along the shores of Lake Michigan made the area ideal for the development of lumbering as an industry.

The county grew slowly at first, reaching a population of only 235 by 1840. The manufacture of lumber and shingles was the principal industry in the early years. Citizens worked to secure government aid for improvement of the harbor. In 1847, the first ship was built in Manitowoc County. Shipbuilding became a significant enterprise in the city of Manitowoc.[3]

---

[1] Louis Falge, ed., History of Manitowoc County, Wisconsin (c. 1911-12; Manitowoc, Wisc.: Manitowoc County Genealogical Society, 1976) 57-60. Today, Manitowoc has grown to encompass Manitowoc Rapids and the two have become a single city.

[2] "Historic Manitowoc County, Wisconsin," Manitowoc County Historical Society, 1964 series, n.p.; Edward Ehlert, "The German Influence in Manitowoc County," Manitowoc County Historical Society, 1973 series, n.p.

[3] The building of larger craft necessitated deeper dredging of the river. In 1872, the channel was 13 feet in depth. In 1881, it varied from 14 to 18 feet. By 1911, a consistent 20-foot depth was attempted. Municipal and federal funds were expended on a series of harbor improvements designed to benefit the shipbuilding industry and, by 1911, amounted to a total of approximately $300,000; see Falge 131, 355.

The large influx of German and Norwegian immigrant farmers in the 1850s precipitated the shift to agriculture as a means of earning a livelihood. The county began to flourish and, by 1860, had over 22,000 residents. Toward the end of the century, wheat lost its position as Wisconsin's, and this county's, leading crop. Agriculture diversified, thereafter, but continued to be the dominant industry. Dairy production became of primary importance to Manitowoc County farmers.[4]

By 1895, the population of the city was about 10,000. A shipyard, with an excellent dry dock and floating dock, served the shipbuilding industry. Other active businesses included: three breweries, 10 cigar factories, an iron works, several wagon factories, a coal dock, six brickyards, and many others. The number of inhabitants in Manitowoc rose to 13,000 by 1903, 18,500 by 1920, and was up to about 20,000 by 1925. The 1919-20 Wisconsin State Gazetteer boasted of the city as a fine trade center surrounded by fertile countryside. The 1924-25 edition noted the many opportunities for the manufacturing shipper with Manitowoc's varied means of transporting goods.[5]

The largest local shipbuilding firm, Manitowoc Ship Building & Dry Dock Company, was established in 1903 when it took over the shipyards operated by Burger & Burger. The firm immediately began the transition from wood craft, which had been Burger & Burger's specialty, to steel and was soon able to deliver various types of steel craft.[6] The Goodrich Transit Company maintenance shops and docks were located nearby and ensured a substantial business in rebuilding work at their fleet. In fact, Goodrich was the shipbuilding company's best customer until 1918. In the 1910s, Manitowoc Ship Building diversified its operations, adding the manufacture of paper mill digesters, tanks, and miscellaneous steel products to its repertoire. By the onset of World War I, the company was building ocean freighters for Norway and Great Britain. During World War II, the facility was selected by the United States government as a center for submarine manufacturing, thus ensuring the Manitowoc Ship Building & Dry Dock Company's continued success and giving it a national reputation.[7]

---

[4] Edward Ehlert, "Highway and Bridge Building in Manitowoc County," Manitowoc County Historical Society, 1976 series, n.p.; Falge 311-13; and Ehlert, "The German Influence" n.p.

[5] Wisconsin State Gazetteer and Business Directory, 1895-96, 1903-04, 1915-16, 1919-20, and 1924-25 eds. (Chicago: R.L. Polk & Co.).

[6] Manitowoc Ship Building & Dry Dock Company ([Manitowoc, Wisc.]: n.p., [1910]).

[7] Manitowoc Ship Building Company, Fifty Years of Problems and Accomplishments, 1902-52 (Manitowoc, Wisc., [1952]) 4, 7, 16.

History of the Bridge

Located on the main commercial thoroughfare of downtown Manitowoc, the Eighth Street Bridge spanned the Manitowoc River in a north-south direction, presiding over the entrance to the city's harbor. This site has been served continuously by a draw bridge since the early 1860s, which accurately reflects the importance of Great Lakes shipping in the history of the area's economy.[8] The construction of the present bridge illustrates the point. When Manitowoc voters authorized a new bascule span for Eighth Street in 1925, the site was occupied by an swing erected in 1892.[9] Although in basically sound condition, the structure provided only a 60-foot clear channel—commodious in its day, but no longer adequate for the passage of the largest Great Lakes vessels.

As Great Lakes ships continued to grow in size, the three predecessor bridges were all replaced to provide increasingly greater channel clearance. The 1926 bascule span, for example, improved on the previous, 1892, swing span by more than fifty per cent, offering a clear channel of 97 feet. The greater clearance was especially required by the city's leading industry the Manitowoc Ship Building Corporation, which found itself unable to build or repair modern wide-beam ships "owing to the inability to have the boats pass through the old draw at 8th street".[10]

By the 1920s, this bottleneck to river traffic had become particularly onerous to the Manitowoc Ship Building Corporation, located in the upper harbor. As the local newspaper explained, "It is recognized generally that much work offered to the plant here could not be taken owing to the inability to have the boats pass through the old draw at 8th Street".[11] In June 1925, the Common Council approved plans and specifications for a new bascule bridge with a clear opening of 97' feet.[12] These documents were prepared, under the supervision of the city

---

[8] According to Louis Falge's History of Manitowoc County, the first Eighth Street Bridge was completed in 1851, but was not a draw structure, see Falge 107-14. Within a decade, however, a drawbridge seems to have been in place. Jeffrey Hess states that a draw span was in place in the early 1850s.

[9] Manitowoc Herald News, 13 August 1926. For original plans, see W.F. Goodhue, consulting engineer, "Eighth Street Bridge," March 1891 (City of Manitowoc, Engineer's Office).

[10] Manitowoc Herald News, 13 August 1926.

[11] Manitowoc Herald News, 13 August 1926.

[12] Manitowoc Common Council, Proceedings, 23 June 1925, Manitowoc City Hall, Manitowoc, Wisconsin.

engineer, by the Milwaukee engineering firm of Klug and Smith, which, six years earlier, had designed a similar double-leaf bascule for a location slightly upstream at Tenth Street (then known as Main Street).[13]

When the Eighth Street Bascule Bridge was completed in the summer of 1926, the local press cheered the fact that "The Manitowoc Shipbuilding corporation employing hundreds of men at peak times will now be in a position to compete against bids on the open market for the repairing and building of ships of the widest beam". It seemed particularly appropriate that the local ship building firm served as fabricator and contractor for the bascule's superstructure. Another Manitowoc firm, MacMullen and Pitz Construction Company, was contractor for the substructure. The local newspaper proudly asserted, "The structure is a Manitowoc product, erected and placed by Manitowoc industry as a lasting monument to a greatness that is constantly growing".[14] Construction costs totaled about $315,000.[15]

When the new bascule was opened, the Manitowoc Herald Press underscored the event's importance by publishing a special "Bridge Edition" with the following editorial comment:

> Ordinarily the opening of a new bridge is not an unusual occasion but in this case it means more than the mere creation of an avenue across a body of water. It is the opening of a river artery that is even more important to the city's well being than that it provides a means of travel from the north to the south side. It provides adequate passage way for the biggest type of vessels to be conveyed up river to one of the biggest ship building yards on the Great Lakes. Not only the biggest but the most active and energetic. It is therefore fitting that the city of Manitowoc provide the means whereby this great institution may profit and in so doing so a full measure of prosperity along the avenues wherein it has its being.[16]

Engineering Description

Resting on concrete abutments and piers, the bridge comprised a double-leaf, through, plate-girder bascule span approached at each end by two, short, deck, girder spans. The north approach was lengthened by a deck concrete-girder span adorned with concrete spandrel walls to

---

[13] Klug and Smith, Plans for Tenth Street Bridge, unpublished, 1919 (City Engineering Office, Manitowoc City Hall).

[14] Manitowoc Herald News, 13 August 1926.

[15] Manitowoc Herald News, 13 August 1926.

[16] Manitowoc Herald News, 13 August 1926.

simulate an arch. The overall width was 63'-8" and the overall length, 250'-0". The total length of the bascule girders was 85'-0" (including counterweight). The distance from the center of the trunnion to the front of the leaf was 60'-0". The clear channel between fenders was 97'-0".

Bordered by ornamental brick railings, the approach spans had reinforced-concrete decks and sidewalks. The bascule span displayed a steel-grid roadway, which replaced the original plank decking. The upper portions of the through, plate, bascule girders served as vehicular barriers, separating the roadway from plank sidewalks cantilevered on metal brackets from the sides of the bascule girders. The sidewalks were bordered by ornamental metal railings.

The four corners of the bascule span were marked by rectangular-plan, hip-roofed, brick-veneered buildings cantilevered on metal brackets from the sides of the bascule girders. Originally, the northeast and southwest buildings served as public comfort stations, while the northwest and southwest buildings functioned as "operator's houses," containing the controls for the lift machinery of their respective leaves. In 1969, the bascule span was converted to "one-man operation" from the southeast house, leaving the other control house vacant for storage.[17] Subsequently, the southwest comfort station, previously a "men's" facility, was remodeled for use by both sexes, and the other comfort house also became a storage room.

Each bascule leaf was structured around two, through, built-up, plate, girders, which were tied together by transverse steel floor beams carrying I-beam deck stringers. Each bascule girder was horizontally pierced by a steel "trunnion," or pivot, riding in a massive bearing. The rear, or shoreward, side of each bascule girder terminated in a series of bolted, cast-iron blocks that functioned as a counterweight. Each counterweight was positioned over a concrete "pit" in the floor of the pier. The two counterweights maintained the leaf in equilibrium, with the center of gravity approximately at the trunnions. The trunnions were supported, on either side of the pit, by longitudinal, built-up, steel girders anchored in the pier masonry.

Although the bridge's lift machinery was rehabilitated in 1969, the new layout resembled the original.[18] Mounted on the pier below the approach span, the lift machinery for each leaf consisted of two, in-line, AC motors driving a series of open, spur, reduction gears on transverse parallel shafts. The last reduction drove a pinion that engaged an open segmental rack bolted to the bottom of the bascule girder beneath the trunnion. The activating pinion was positioned at the front, or river, end of the rack, slightly forward of the trunnion. Since the leaf was counterbalanced, the power train was designed primarily to overcome the friction and inertia of the system. When the power train was set in motion, the leaf pivoted on the trunnion so that the

---

[17] Mike Hawley, Director, Manitowoc Public Works Department, Interview by Jeffrey A. Hess, 18 November 1986.

[18] Hawley, interview; Hazelet and Erdal.

front end rose and the counterweights descended into the pit. When the motor was reversed, the leaves closed and the counterweights rose. Although both motors were customarily used, a single motor was capable of operating the leaf.

The break in the leaf occurred on the river side of the trunnion so that only the rear ends of the bascule girders experienced uplift from the weight of traffic. The live load was transferred to the bridge foundations by means of a slightly protruding "heel plate" at the end of each bascule girder. In closed position, the heel plate nestled against a transverse "bumper beam" attached to steel columns embedded in the pier masonry, thus anchoring the bascule girder. To ensure rigidity of the bascule span under traffic, the front ends of the bascule girders were equipped with motor-driven ram-and-socket center locks that tie the leaves together below the deck.

History of Bascules in Wisconsin

The outcome of two turn-of-the-century bridge design competitions—one in Chicago and one in Milwaukee—established the popularity of the simple-trunnion bascule in Wisconsin. In 1898, the Scherzer Company won the Canal Street Bridge project in Chicago with their patented design for a "rolling lift" bascule. Scherzer's competition in the Canal Street Bridge design contest was inventor Max G. Schinke who, represented by Milwaukee Bridge and Iron Works, submitted his own patented version of a rolling lift. After this victory, the Scherzer Company seemed poised to monopolize future movable-bridge construction in Chicago. However, this structure would be among its last highway commissions in Chicago, and the company never managed to enter the Milwaukee market at all. The nemesis for the Scherzer was not another patent holder, and least of all not Schinke, who sank into obscurity soon after the Canal Street competition. Instead, competition came from an unpatented bascule type, which found its strongest advocates in the city engineering departments of Chicago and Milwaukee.

In 1899, the Bridge Division of the Chicago Department of Public Works undertook "a critical analysis of the literature on movable bridges in the United States and Europe, with a view to selecting a type of bridge most suitable to the Chicago River and its branches."[19] A year later, when the city sponsored a competition for the best drawbridge design, the Bridge Division was ready to enter the lists under its own colors. The judges reviewed a total of eight proposals: three from the city's engineering staff, five from private parties. The winning proposal was by City Engineer John Ericson, who had based his design on the double-leaf, bascule span of the Tower Bridge in London, England.[20]

---

[19] Donald N. Becker, "Development of the Chicago Type Bascule Bridge," American Society of Civil Engineers Proceedings (Feb. 1943): 270.

[20] "The Chicago Type of Bascule Bridge," Engineering Record 21 July 1900: 50-52; Earle G. Benson, "The Development of the Chicago Type Bascule Bridge," Armour Engineer 22 (March 1931): 82.

Completed in 1894, the Tower Bridge was an updated version of a simple-trunnion bascule, the oldest of all drawbridge types. In the manner of a seesaw, each leaf-vertically rotated on a horizontal steel pivot, or trunnion. Powered by a steam engine, the lift machinery operated the draw by means of a pinion engaging a curved rack mounted on the upper side of the rear end of the leaf. As the front end of the leaf tilted upward, the counterweighted rear end descended into a masonry pit built into the abutment. When the motor was reversed, the leaf pivoted into closed position, bringing the rear end of the leaf to rest against a transverse anchor girder. This girder also resisted the upward thrust of the leaf's rear end when traffic crossed the span. In motion, the leaf was entirely supported by the trunnion. When closed, its weight was transferred to a pedestal mounted on the pier directly in front of the trunnion. To ensure rigidity under traffic, the two leaves were tied together by a locking mechanism at their front ends, a necessary feature of double-leaf design.[21]

In delivering their verdict, the judges praised the design for its extreme simplicity, which kept "the number of moving parts to the minimum." They also were pleased by its unpatented status, which promised a minimum of legal entanglements. They were most impressed, however, by the design's apparent suitability for Chicago conditions. Unlike a rolling-lift leaf, which shifted its center of gravity back and forth over the abutments, a simple-trunnion leaf maintained a constant center of gravity. As the judges noted, this difference was "of no great consequence if the piers are placed on an unyielding foundation." But in Chicago, where bedrock lay far below the surface at many bridge sites, unyielding foundations were often difficult to achieve. By creating less stress on bridge abutments, the simple-trunnion design seemed to have an inherent advantage over the rolling lift.[22]

Chicago completed its first, simple-trunnion, highway, bascule bridge over the Chicago River at Cortland Street (originally named Clybourn Street) in May 1902. It was a double-leaf structure providing a clear channel of 115 feet. Displaying a through truss configuration with a curved rack rising above the roadway at the rear of the leaf, the bridge typified the eight other highway bascules built by the city during that decade- Over the next thirty years, Chicago municipal engineers refined the bascule's lift machinery, counterweights, and substructure. They also introduced pony truss and deck truss models. Although some of these modifications significantly improved operating efficiency, the Chicago bascule bridge of the late 1930s remained a very recognizable descendant of Ericson's original design.[23]

---

[21] On the Tower Bridge bascule, see Otis Ellis Hovey, Movable Bridges, vol. 1 (New York: John Wiley and Sons, 1926) 83-88.

[22] "The Chicago Type" 51-52.

[23] On the Cortland Street Bridge, see Becker 274. He also thoroughly discusses subsequent design modifications in the Chicago bascule type; see Becker 279-93. As of 1988, the Cortland Bridge was still carrying highway traffic, although its lift machinery had been deactivated; see Donald C. Jackson, Great American Bridges (Washington, D.C.: Preservation Press, 1988) 197.

At the beginning of the twentieth century, Chicago was in the forefront of American architecture, engineering, and planning. Even at the time, people characterized the city's bold, new achievements as the Chicago School. Given the propensity to associate Chicago with innovation, it is understandable that the terms simple-trunnion bascule and Chicago Type Bascule eventually became synonymous in the technical literature.[24] Unfortunately, this equation obscured the contributions of other cities. Milwaukee, for example, was developing an influential, simple-trunnion type of its own at the same time that Chicago was perfecting its namesake bascule. Milwaukee also completed its first example three months before the Cortland Street Bridge opened in Chicago.

In the spring of 1898, public pressure to replace the cumbersome, 30-year-old, swing span that obstructed the Milwaukee River in the heart of the downtown district at Grand (Wisconsin) Avenue initiated Milwaukee's courtship of the simple-trunnion bascule. In August 1900, the city called for bids which brought a response from only two firms: Wisconsin Bridge and Iron Works and Milwaukee Bridge and Iron Works. Operating as full-service bridge companies, they had both built Schinke bascule spans in Milwaukee. In its Grand (Wisconsin) Avenue Bridge proposal, Wisconsin Bridge and Iron Works submitted a Schinke design. Milwaukee Bridge and Iron Works's strategy seems to have been dictated by its recent loss of two Chicago bridge contracts to the Scherzer Rolling Lift Bridge Company. On both occasions, Milwaukee Bridge and Iron Works had proposed Schinke spans. Apparently deciding to learn from its mistakes, the company forged an alliance with its former rival in Chicago and submitted a Scherzer design.[25]

Milwaukee Bridge and Iron Works's victory was short-lived. Six months later, the Common Council canceled the entire project. The Council's dissatisfaction had nothing to do with the nature of Milwaukee Bridge and Iron Works's design, but rather with the project's specification of a 64-foot-wide bridge, which some aldermen believed was too narrow for the downtown site.

---

[24] In his 1916 text, Bridge Engineering, Waddell set the example by offering "the Chicago City Type" as the only representative of simple-trunnion bascule design; see J.A.L. Waddell, Bridge Engineering, vol. 1 (New York: John Wiley and Sons, 1916) 709. Seven years later, when Hool and Kinne brought out their text, the discussion of bascule bridges began with the heading, "Simple Trunnion or 'Chicago Type'"; see George A. Hool and W.S. Kinne, eds., Movable and Long-Span Steel Bridges (New York: McGraw-Hill Book Company, 1923) 20. By the 1970s, such headings were to read: "Chicago (or simple) Trunnion"—as in Bridge Inspector's Training Manual (Washington, D.C.: U. S. Department of Transportation, Federal Highway Administration, 1979) 5-109. This emphasis on the Chicago bascule was encouraged by the fact that the design was copied and publicized in other cities; see, for example, "The Bascule Span on the Passyunk Avenue Bridge [Philadelphia]," Engineering Record 30 Dec. 1911: 756-758; F. A. Rapp, "Three Double-Leaf Bascule Bridges at Seattle, Wash.," Engineering News-Record 8 April 1920: 718-722.

[25] John Geist, "The Lift Bridge of the Sixteenth St. Viaduct, Milwaukee, Wis.," Engineering News 7 March 1895: 146; M. G. Schinke, "The New Huron Street Lift Bridge, Milwaukee Wis.," Engineering News 22 April 1897: 253-55.

The city readvertised the Grand (Wisconsin) Avenue bridge project in the spring of 1901. Both original bidders responded, although Milwaukee Bridge and Iron Works was now part of the American Bridge Company conglomerate. The Council's minutes show that the American Bridge Company actually presented two proposals, both more expensive than its original offer. Although the precise nature of the designs is unknown, they presumably were Scherzer rolling-lift bascules. In contrast, Wisconsin Bridge and Iron Works maintained its original price, but drastically altered its design. Jettisoning the Schinke bascule, which had not won a competition in five years, Wisconsin Bridge and Iron Works boldly embraced the newest form of movable-bridge technology and captured the contract with a double-leaf, simple-trunnion span.[26]

Wisconsin Bridge and Iron Works undoubtedly drew inspiration from the simple-trunnion bascule recently adopted, but not yet built, by the city of Chicago. Its own design, however, differed in three important respects. First, Wisconsin Bridge and Iron Works rejected the truss configuration in favor of the arched plate-girder design developed by the Scherzer Company for the first round of bids. Second, Wisconsin Bridge and Iron Works developed a new rack-and-pinion operating mechanism in which each plate girder has bolted to it a cast-steel spider carrying the rack segment, which is concentric with the trunnion. Third, Wisconsin Bridge and Iron Works shifted the break in the roadway (i.e., the juncture between the approach span and the bascule span) from the river side of the trunnion, as in the Chicago design, to the shoreward side of the trunnion. As a result of this decision, the front end of the leaf tended to pivot upward when traffic entered the span, necessitating the provision of heel locks, as well as center locks, to keep the bridge closed under live load.[27]

When the Grand (Wisconsin) Avenue Bridge opened to traffic on March 10, 1902, it represented, as the contemporary press noted, the first bridge of this type to be completed in this country, although some bridges of a similar type were then being built across the Chicago River.[28] For the most part, the bridge was well received by the engineering profession. One commentator, however, did take issue both with the design of the rack ("it would have been better and cheaper to place it right on the center line of the main girders at the bottom flange") and with the location of the roadway break ("every time the bridge is raised the dirt on the swinging parts falls down on the machinery"). This last flaw was rectified when the city built its second simple-trunnion

---

[26] The bridge's saga can be followed in the Milwaukee Common Council's minutes for 14 January, 11 February, 1 May and 20 May 1901; see also "Accepted Design for Grand Avenue Bridge," unidentified newspaper clipping dated April 24, 1902, Milwaukee Feature Collection, microfilm, Milwaukee County Historical Society.

[27] "The Grand Avenue Bascule Bridge, Milwaukee," Engineering Record 12 July 1902: 38-40; "Bascule Bridge at Grand Ave., Milwaukee, Wis.," Engineering News 3 July 1902: 19-22.

[28] "Bascule Bridge at Grand Ave." 19.

bascule—a double-leaf, plate girder structure completed over the Milwaukee River at Broadway in 1903. On the Broadway Bridge, the break in the roadway was placed on the river side of the trunnion, thereby eliminating the need for heel locks, as well as preventing water, dirt and snow from being deposited on the machinery below as is the case when the break in the floor is back of the trunnions.[29] The operating rack, however, remained the same as on the Grand Avenue Bridge.

Although there is no question that Wisconsin Bridge and Iron Works introduced the simple-trunnion bascule to Milwaukee, the identity of the design engineer has not been definitely established. It may have been John Geist (1862-1923), a prominent local engineer whose obituary in the Milwaukee press credited him with being "the inventor of the modern bascule bridge." Born in Bergen, Norway, Geist immigrated to Milwaukee in 1883, taking his first job as a draftsman with Milwaukee Bridge and Iron Works. Eleven years later, he moved to the rival Wisconsin Bridge and Iron Works as chief engineer. In that capacity, he designed the Schinke span of the Sixteenth Street Viaduct. By the time of the Grand Avenue project, Geist had left Wisconsin Bridge and Iron Works to set up a private practice as a consulting engineer, but it is certainly possible his former employers retained his services to prepare their Grand Avenue Bridge bids. It was in just such a role of consulting engineer that Geist designed the Broadway Bridge. On that project, there is no doubt about his contribution.[30]

Geist's Broadway Bridge design required one last modification to be transformed into what might best be called the "Milwaukee Type Bascule". It required the relocation of the segmental rack on the plate girder, from its side-mounted position concentric to the trunnion to a bottom-mounted position below the trunnion. This alteration would eliminate both the expense of the spider mount (since the rack could be bolted directly to the bottom flange of the girder) and the shearing stress on the rack itself (which now engaged the pinion in the same vertical plane as the girder). The improved rack arrangement appeared for the first time on the double-leaf, plate girder Muskego Avenue Bridge (P-4-610), which opened a clear channel of 82 feet in the Menomonee River in 1904.

---

[29] John Geist, "The Broadway Bascule Bridge at Milwaukee, Wis.," Engineering News 14 July 1904: 27. In addition, Geist's signature appears on the original plans of the Broadway Bridge on file at the Milwaukee Bureau of Bridges and Public Buildings. The Bureau also has the original plans for the Grand Avenue Bridge, which, unfortunately, do not carry the name, signature, or initials of a designing engineer. The plans merely state, "Designed by Wisconsin Bridge and Iron Works."

[30] Geist himself published an article about the bridge, stating that it was "designed by the writer" for "Mr. Adolph F. Bues, of Milwaukee, [who] was contractor for the structure." On Geist's career, see "Bascule Bridge Designer Dead," Milwaukee Journal 1 Oct. 1923; Kenneth Bjork, Saga in Steel and Concrete, Norwegian Engineers in America (Northfield, Minn.: Norwegian-American Historical Association, 1947) 157-159. Geist's employment with the various Milwaukee bridge companies can be traced in the city directories, 1883-1898.

The Muskego Avenue Bridge is Wisconsin's oldest, surviving bascule. It is also one of the nations few, early twentieth-century bascules still in operation as a movable span. Its greatest significance, however, lies in the fact that it was the prototype for a distinctive type of simple-trunnion design, characterized by plate-girder construction and a bottom-mounted, segmental rack. Having proved successful in the Muskego Avenue Bridge, this design was repeated in all thirteen bascule spans subsequently built by the City of Milwaukee before World War II. The design received national recognition—albeit without any acknowledgment of its Milwaukee origin—as early as 1905, when it was selected by the federal government for the Anacostia Bridge over the Potomac River in Washington, D.C. Although its geographic distribution in the United States is unknown, the Milwaukee Type Bascule apparently exercised a fair amount of influence on movable bridge construction. When the U.S. Department of Transportation published its *Bridge Inspector's Manual for Movable Bridges* in 1977, the idealized illustration for "trunnion bascules" shows a plate girder span with a bottom-mounted, segmental rack.[31]

The Muskego Avenue Bridge marked the emergence of a new bridge contractor in the Milwaukee area, called, appropriately enough, the Milwaukee Bridge Company; it also signaled the final defeat of the Scherzer Company in the Milwaukee market. The Milwaukee Bridge Company began business in September 1902 under the name of the Milwaukee Steel Structural Company. Apparently, the Muskego Avenue Bridge was its first proposal. Although its bid of $93,800 for a double-leaf, simple-trunnion bascule was the lowest offered, the Common Council rejected it, along with all the other proposals, on the grounds that the price asked "is exorbitant compared with contracts recently awarded for bridge construction." By way of comparison, an investigating committee pointed out that the Grand Avenue Bridge had been built for $7,800 less, even though it was a larger and more ornate structure than the one contemplated for Muskego Avenue.[32]

The city of Milwaukee accepted new bids for the Muskego Avenue Bridge project in March 1903. By that time, the Milwaukee Structural Steel Company had changed its name to the Milwaukee Bridge Company, but its proposal remained the same. The only other bidder was the

---

[31] Bridge Inspector's Manual for Movable Bridges (Washington, D.C.: U.S. Department of Transportation—Federal Highway Administration, 1977) 1.22-1.24 (see especially Figure 1-35). Hovey describes the Anacostia Bridge as a separate type of bascule without crediting its Milwaukee antecedents; see Hovey 89-91 and "The Anacostia Bridge," Engineering Record 19 Aug. 1905: 207-10 and 2 Sept. 1905: 271-73. Since the U.S. Army was responsible for approving all movable-bridge plans, there is no doubt that its engineering staff had reviewed the Milwaukee bascule design prior to drawing up plans for the Anacostia Bridge.

[32] See minutes of 21 April, 6 Oct., 1 and 29 Dec. 1902, 12 Jan. 1903 as recorded in Proceedings of the Common Council of Milwaukee for the Year Ending April 21st, 1903 (Milwaukee: Edward Keogh Press: 1903) 50, 956, 1162, 1902, 1321-1322. According to incorporation documents in the possession of the Milwaukee County Historical Society, the Milwaukee Steel Structural Co. was established on 2 Sept. 1902 and renamed Milwaukee Bridge Company on 23 Feb. 1903 (Vol. Q, 348, 601).

Scherzer Rolling Lift Bridge Company of Chicago, which entered the competition under its own name. The company's grim determination to win a Milwaukee contract was evidenced by its preparation of five separate, detailed proposals, ranging in price from $80,000 to $90,000. Since each Scherzer proposal was cheaper than the offer of its Milwaukee competitor, the Chicago firm clearly had won the bidding contest. The Milwaukee Department of Public Works, however, refused to endorse the Scherzer Company for the contract. Apparently caught between the demands of fiscal responsibility and hometown loyalty, the department declined to make any recommendation at all. As the Commissioners of Public Works tersely explained to the Common Council:

> The Scherzer Co. bids on the "rolling lift" bridge, while the Milwaukee Co. bids on the "Trunnion type". There is among City Officials a difference of opinion as to which bridge is the better, and under the circumstances we prefer to make no recommendation as to which bridge to accept. It therefore remains for your Honorable Body to select such bridge as you may deem for the best interests of the City.[33]

In a sense, the City had already made up its mind. While the Commissioners of Public Works were publicly sidestepping the Muskego Avenue Bridge project, the city engineer was circulating specifications for another bascule over the Menomonee River at West Water Street (North Plankington Avenue) that explicitly called for a trunnion design, thereby eliminating the Scherzer rolling lift from future consideration. The Common Council quickly fell into line. Despite its previous outrage at the cost, it awarded the Muskego Avenue Bridge contract to the Milwaukee Bridge Company. It is possible the council members based their decision solely on the technical merits of simple-trunnion versus rolling-lift design. More probably they understood the demerits of selecting a Chicago over a Milwaukee firm, especially since the local company was not the fledgling enterprise it appeared to be.[34]

The 1929 Kilbourn Avenue Bridge and the 1940 Cherry Street Bridge—both examples of simple-trunnion construction—highlight the city's continued allegiance to this bascule type. Manitowoc built two simple-trunnion bridges, the Tenth Street Bridge (1920) and the Eighth Street Bridge (1926). Today, there are nine bascules of this type remaining in the state, all are located in Milwaukee.

---

[33] Minutes of 27 March 1903, as recorded in Proceedings of the Common Council 1693.

[34] On the city engineer's specifications for the West Water Street (North Plankington Avenue) Bridge, see minutes of 15 and 19 Dec. 1902 as recorded in Proceedings of the Common Council...1903 1233, 1259; minutes of 25 May 1903 as recorded in Proceedings of the Common Council of the City of Milwaukee for the Year Ending April 15, 1904 (Milwaukee: Edward Keogh Press, 1904) 161. The Common Council awarded the contract to the Milwaukee Bridge on 4 May 1903 as recorded in Proceedings of the Common Council...1904 50.

BIBLIOGRAPHY

Primary Sources

Goodhue, W.F., Consulting Engineer. "Eighth Street Bridge," March 1891. City of Manitowoc, Engineer's Office.

Hazelet and Erdal. Rehabilitation Plans for Eighth Street Bridge. Unpublished, 1968. City Engineering Office, Manitowoc City Hall.

Klug and Smith. Plans for the Eighth Street Bridge. Unpublished, 1925. City Engineering Office, Manitowoc City Hall.

_____. Plans for Tenth Street Bridge. Unpublished, 1919. City Engineering Office, Manitowoc City Hall.

Milwaukee Bureau of Bridges and Public Buildings. Original plans of the Broadway Bridge and the Grand Avenue Bridge. Milwaukee, Wisconsin.

Milwaukee Steel Structural Company. "Incorporation Documents." Milwaukee County Historical Society, Milwaukee, Wisconsin.

Wisconsin Department of Transportation. Bridge Files. Bridge No. P-36-914.

Wisconsin Maritime Museum. Photographic Collection. Manitowoc, Wisconsin.

Secondary Sources

"Accepted Design for Grand Avenue Bridge." Unidentified newspaper clipping dated 24 April 1902. Milwaukee Feature Collection (microfilm), Milwaukee County Historical Society.

"The Anacostia Bridge." Engineering Record 19 Aug. 1905: 207-10 and 2 Sept. 1905: 271-73.

"Bascule Bridge at Grand Ave., Milwaukee, Wis." Engineering News 3 July 1902: 19-22.

"The Bascule Span on the Passyunk Avenue Bridge [Philadelphia]." Engineering Record 30 Dec. 1911: 756-758.

Becker, Donald N. "Development of the Chicago Type Bascule Bridge." American Society of Civil Engineers Proceedings (Feb. 1943): 270.

Benson, Earle G. "The Development of the Chicago Type Bascule Bridge." Armour Engineer 22 (March 1931): 82.

Bjork, Kenneth. Saga in Steel and Concrete, Norwegian Engineers in America. Northfield, Minn.: Norwegian-American Historical Association, 1947.

Bridge Inspector's Manual for Movable Bridges. Washington, D.C.: U.S. Department of Transportation—Federal Highway Administration, 1977.

Bridge Inspector's Training Manual. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979.

"The Chicago Type of Bascule Bridge." Engineering Record 21 July 1900: 50-52.

Ehlert, Edward. "The German Influence in Manitowoc County," Manitowoc County Historical Society, 1973 series.

_____. "Highway and Bridge Building in Manitowoc County," Manitowoc County Historical Society, 1976 series.

Falge, Louis, ed. History of Manitowoc County, Wisconsin. c. 1911-12. Manitowoc, Wisc.: Manitowoc County Genealogical Society, 1976.

Geist, John. "The Broadway Bascule Bridge at Milwaukee, Wis." Engineering News 14 July 1904: 27.

_____. "The Lift Bridge of the Sixteenth St. Viaduct, Milwaukee, Wis." Engineering News 7 March 1895: 146.

"The Grand Avenue Bascule Bridge, Milwaukee." Engineering Record 12 July 1902: 38-40.

Hawley, Mike, Director, Manitowoc Public Works Department. Interview by Jeffrey A. Hess, 18 November 1986.

Hess, Jeffrey A. and Robert M. Frame III. Movable Bridges in Wisconsin. Wisconsin Department of Transportation, forthcoming.

"Historic Manitowoc County, Wisconsin," Manitowoc County Historical Society, 1964 series.

Hool, George A. and W.S. Kinne, eds. Movable and Long-Span Steel Bridges. New York: McGraw-Hill Book Company, 1923.

Hovey, Otis Ellis. Movable Bridges, Vol. 1. New York: John Wiley and Sons, 1926.

Jackson, Donald C. Great American Bridges. Washington, D.C.: Preservation Press, 1988.

Manitowoc Common Council. Proceedings, 23 June 1925. Manitowoc City Hall, Manitowoc, Wisconsin.

Manitowoc Ship Building Company. Fifty Years of Problems and Accomplishments, 1902-52. Manitowoc, Wisc., [1952].

Manitowoc Ship Building & Dry Dock Company. [Manitowoc, Wisc.]: n.p., [1910].

Proceedings of the Common Council of Milwaukee for the Year Ending April 21st, 1903. Milwaukee: Edward Keogh Press: 1903.

Proceedings of the Common Council of the City of Milwaukee for the Year Ending April 15, 1904. Milwaukee: Edward Keogh Press, 1904.

Rapp, F.A. "Three Double-Leaf Bascule Bridges at Seattle, Wash." Engineering News-Record 8 April 1920: 718-722.

Schinke, M.G. "The New Huron Street Lift Bridge, Milwaukee Wis." Engineering News 22 April 1897: 253-55.

Waddell, J.A.L. Bridge Engineering, Vol. 1. New York: John Wiley and Sons, 1916.

Wisconsin State Gazetteer and Business Directory, 1895-96, 1903-04, 1915-16, 1919-20, and 1924-25 eds. Chicago: R.L. Polk & Co.

Maps

Illustrated Historical Atlas of Manitowoc County, Wisconsin. Manitowoc: G.V. Nash, 1878.

Map of Manitowoc County, Wisconsin. E.M. Harney, publisher, 1872.

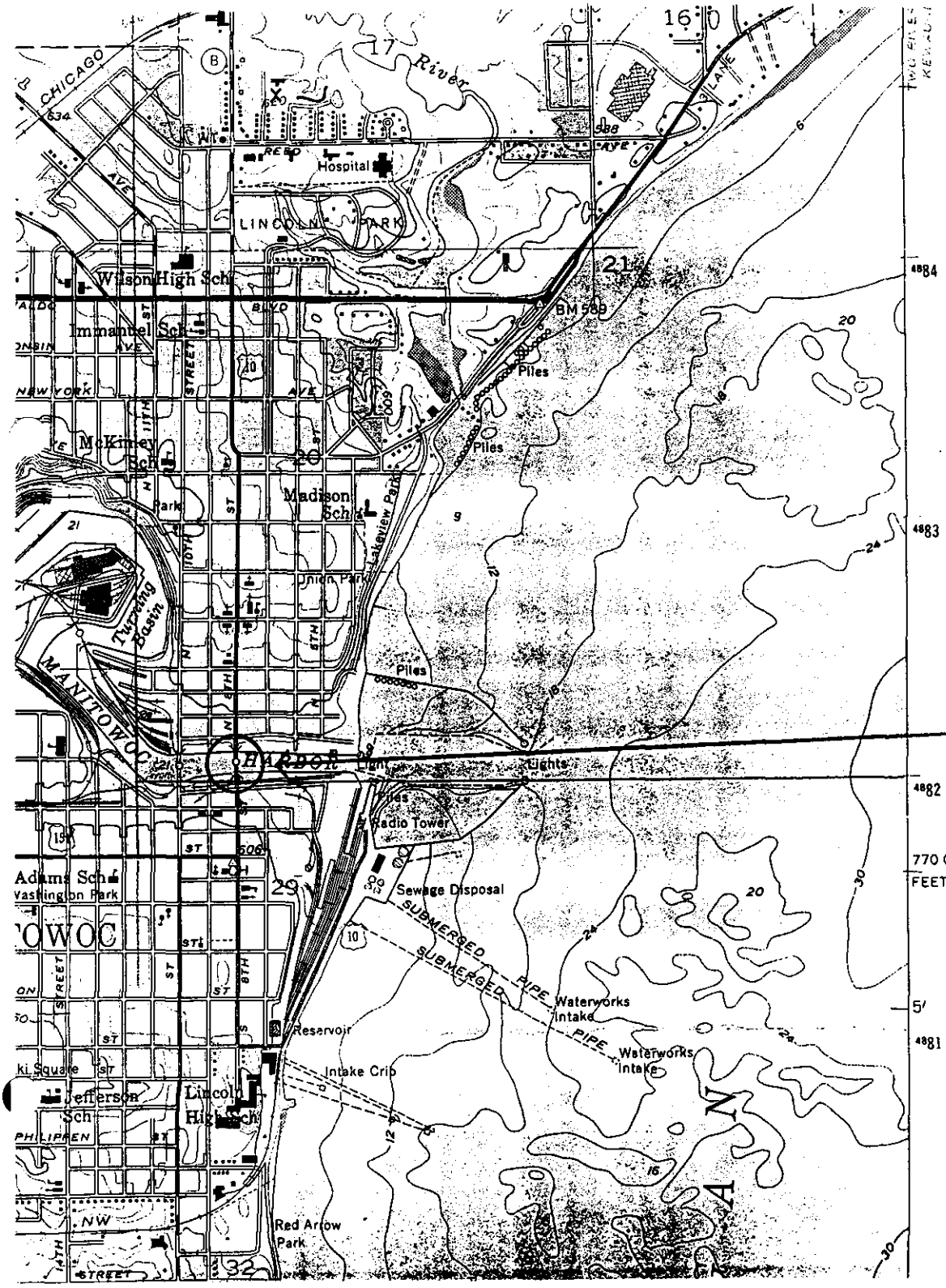
Platbook of Manitowoc and Calumet Counties. Minneapolis: C.M. Foote & Co., 1893.

Newspapers

"Bascule Bridge Designer Dead." Milwaukee Journal 1 Oct. 1923.

Manitowoc Herald News. 13 August 1926.

Fig. 1 USGS Quad: Manitowoc, Wisconsin (7.5 minute series)
UTM: South abutment: 16/447395/4882035
North abutment: 16/447395/4882115



Eighth Street Bridge
UTM references
S abutment:
16/447395/4882035
N abutment:
16/447395/4882115

Fig. 2 Plan of Bridge (source: Klug and Smith. Plans for the Eighth Street Bridge. Unpublished, 1925. City Engineering Office, Manitowoc City Hall).

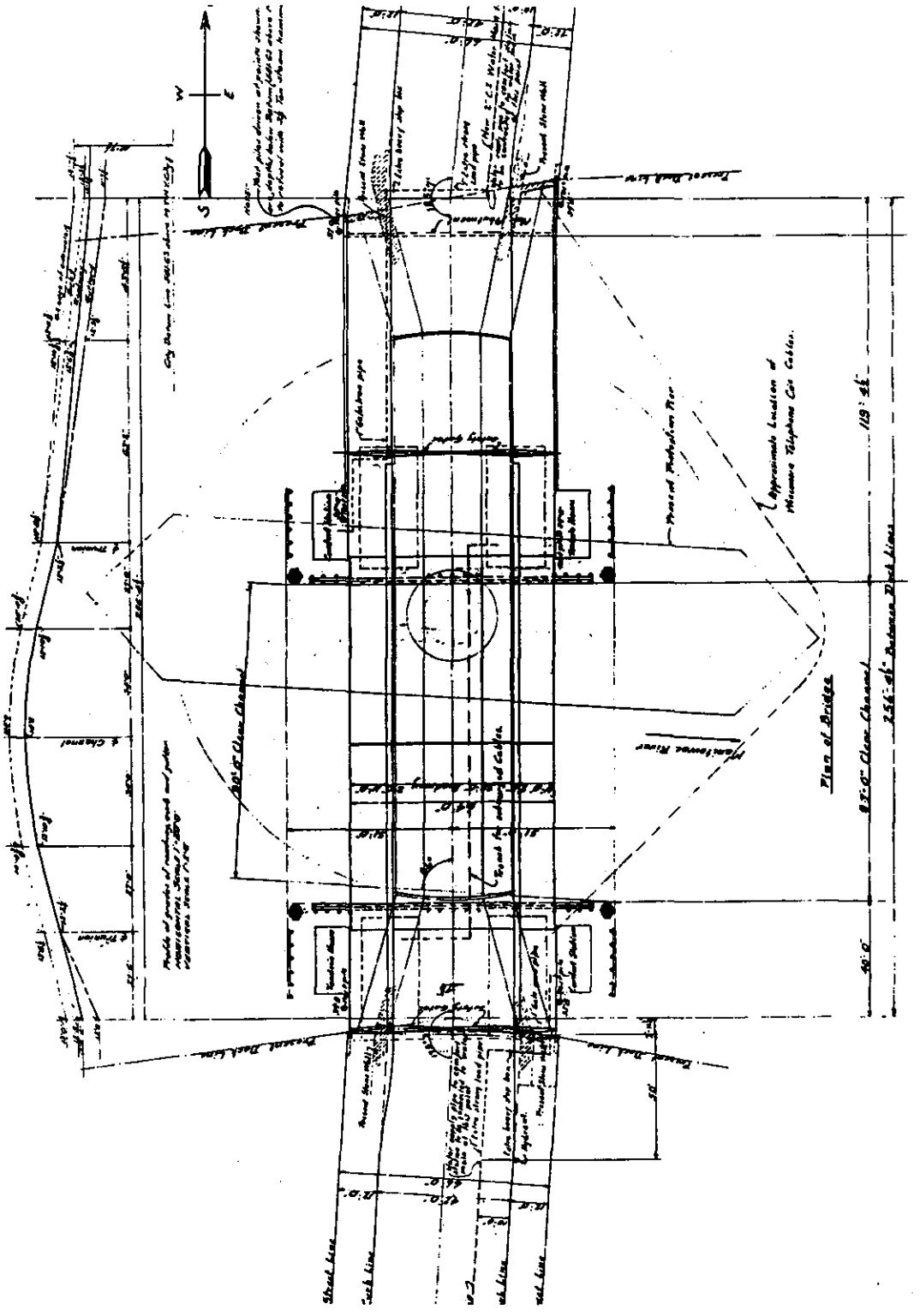


Fig. 3 Elevation (source: Klug and Smith).

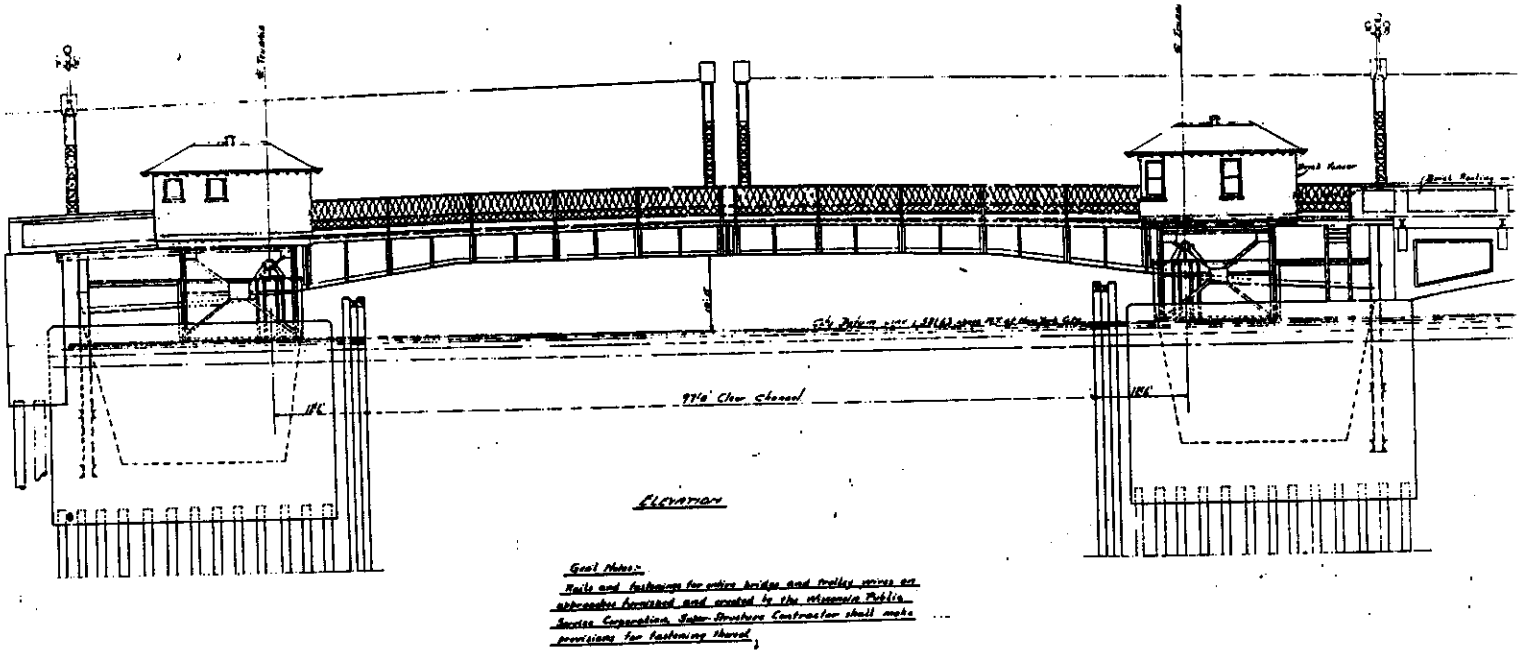


Fig. 4 Plan of Tender's House and Ladies' Comfort Station on North Approach (source: Klug and Smith).

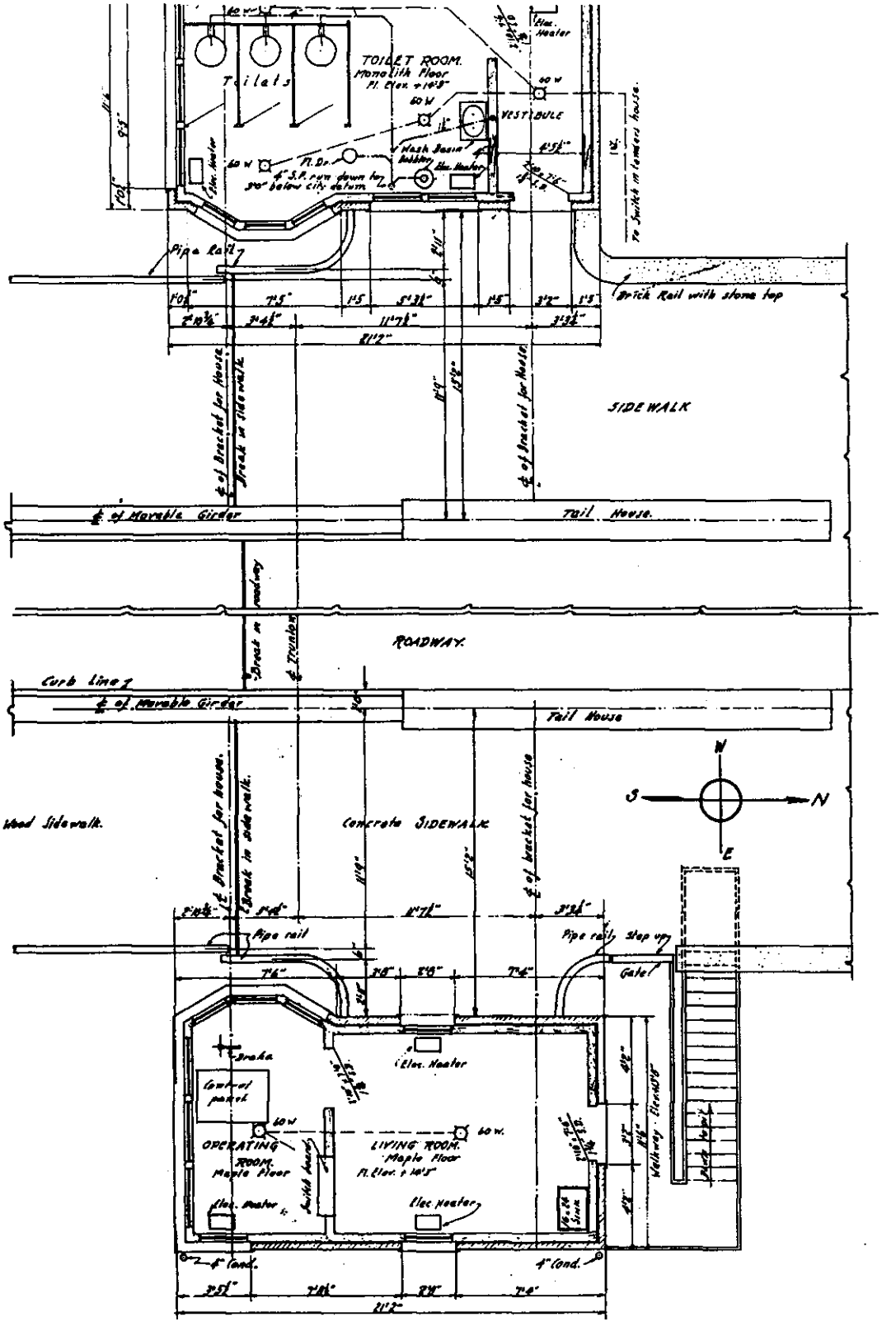


Fig. 5 Elevation of Machinery Platform and Operator's House (source: Klug and Smith).

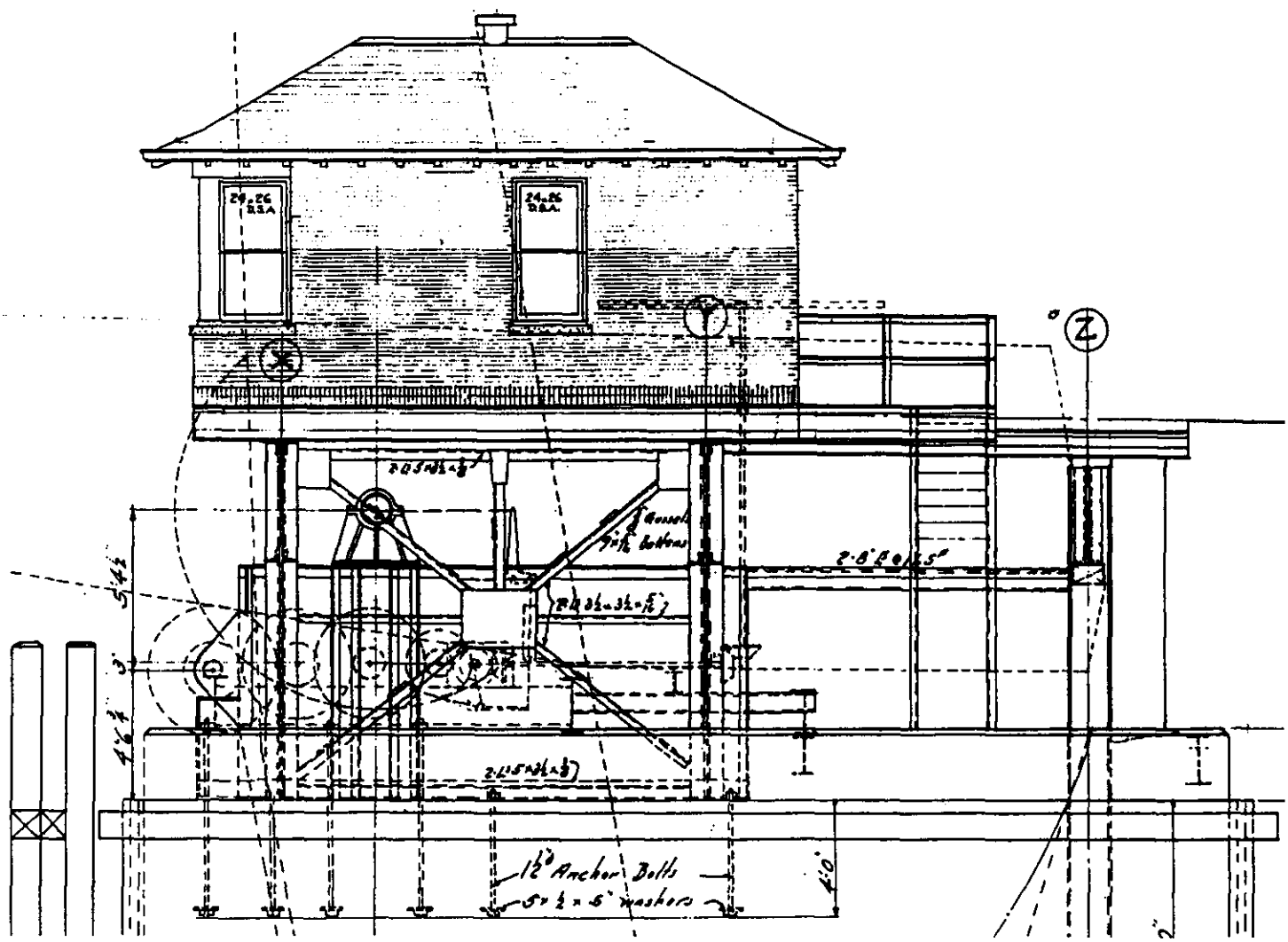


Fig. 6 Detail of Moveable Leaf, Rack (source: Klug and Smith).

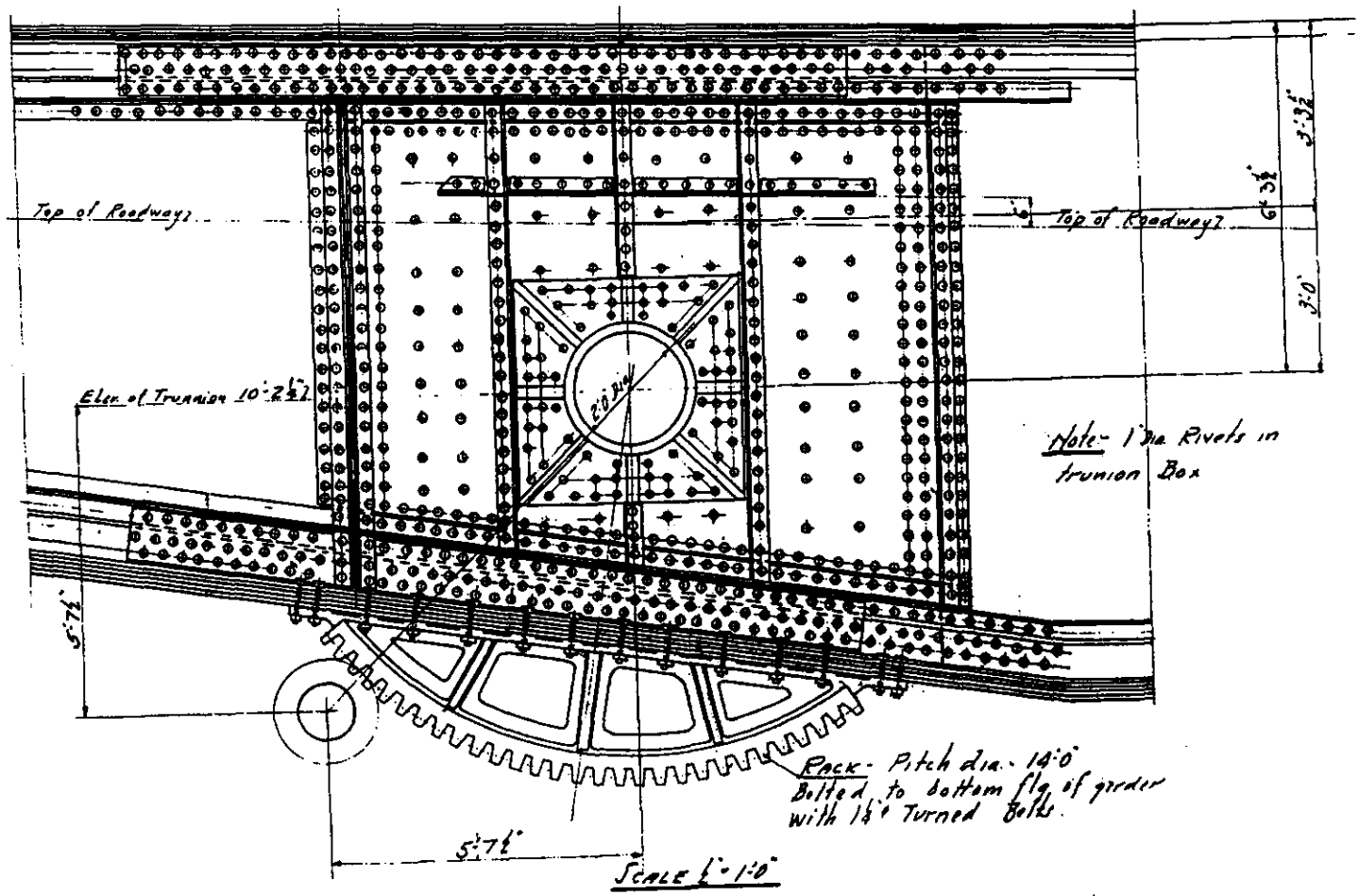
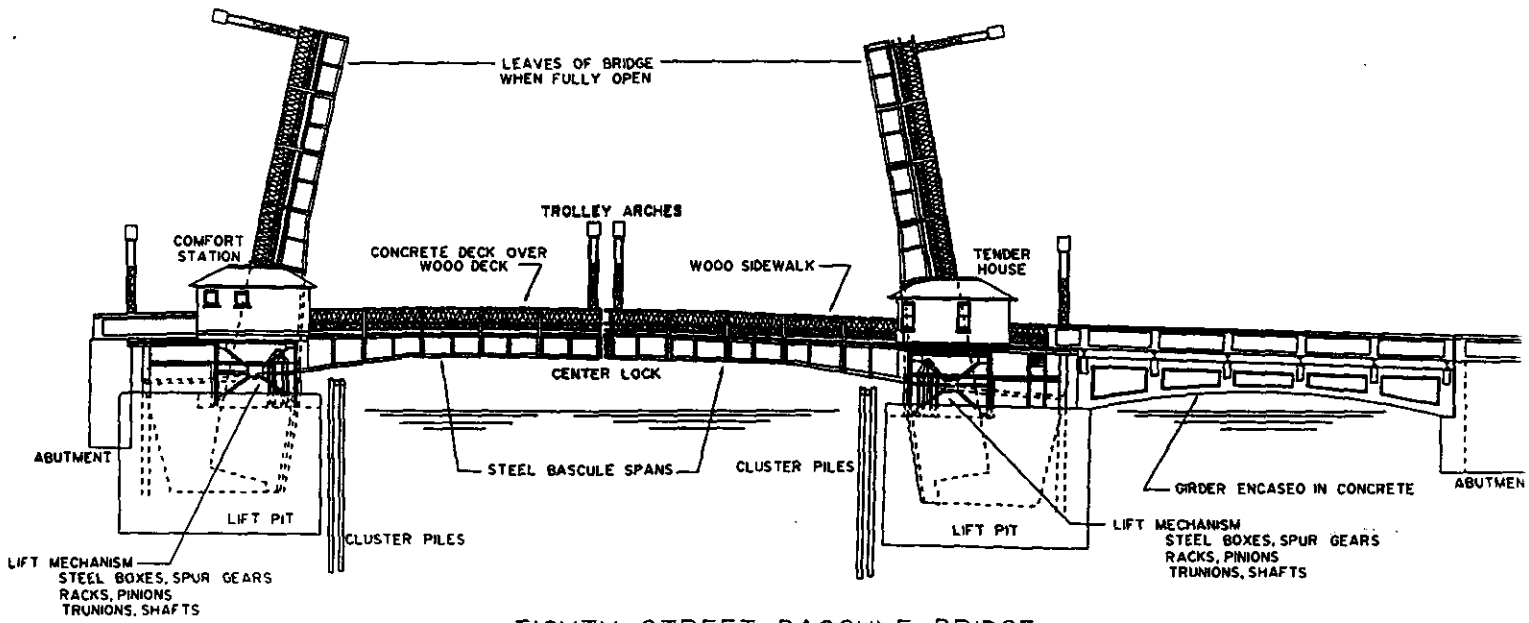


Fig. 7 Drawing Showing Operation of Bridge with Parts Identified (produced by Mead & Hunt, Inc., 1994 from original plans).



EIGHTH STREET BASCULE BRIDGE

Fig. 8 HISTORIC VIEW OF BRIDGE DURING CONSTRUCTION, LOOKING EAST
(Original photograph located at the Wisconsin Maritime Museum).

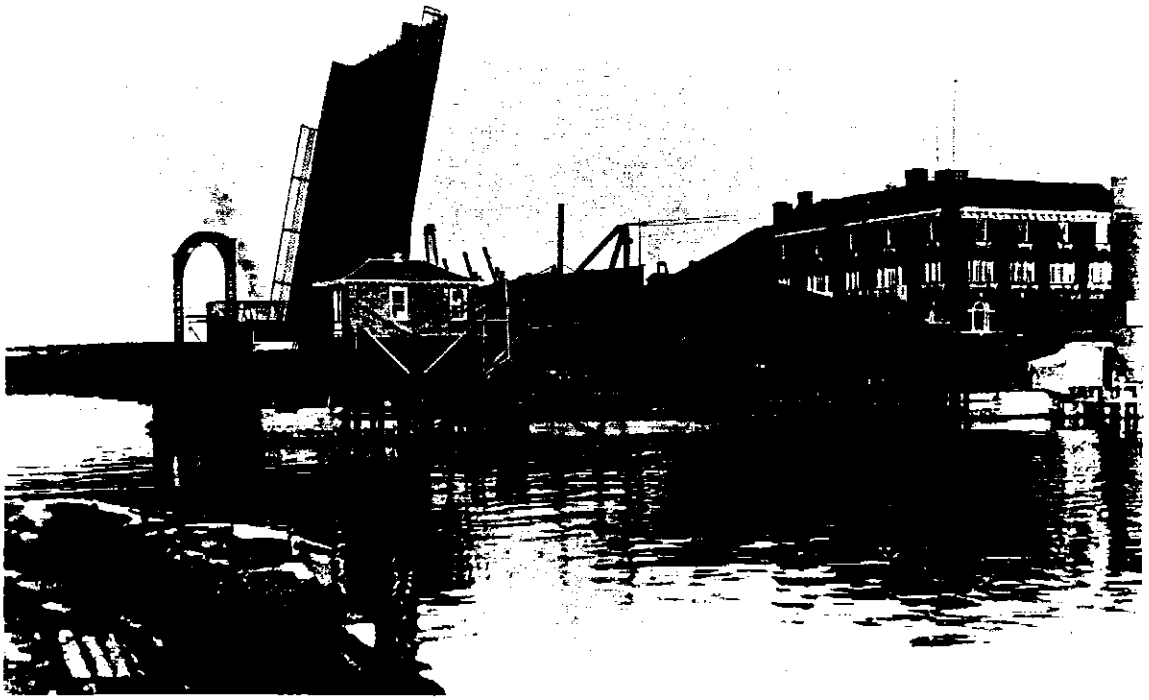


Fig. 9 HISTORIC PHOTO WITH SPANS OPENED, LOOKING EAST (Original photograph located at the Wisconsin Maritime Museum).

Fig. 10 VIEW OF DECK LOOKING SOUTH (Original photograph located at the Wisconsin State Historic Preservation Office).

Fig. 11 VIEW OF NORTHWEST OPERATOR'S HOUSE (Original photograph located at the Wisconsin Maritime Museum).

Fig. 12 DETAIL OF SOUTHEAST OPERATOR'S HOUSE (Original photograph located at the Wisconsin Maritime Museum).

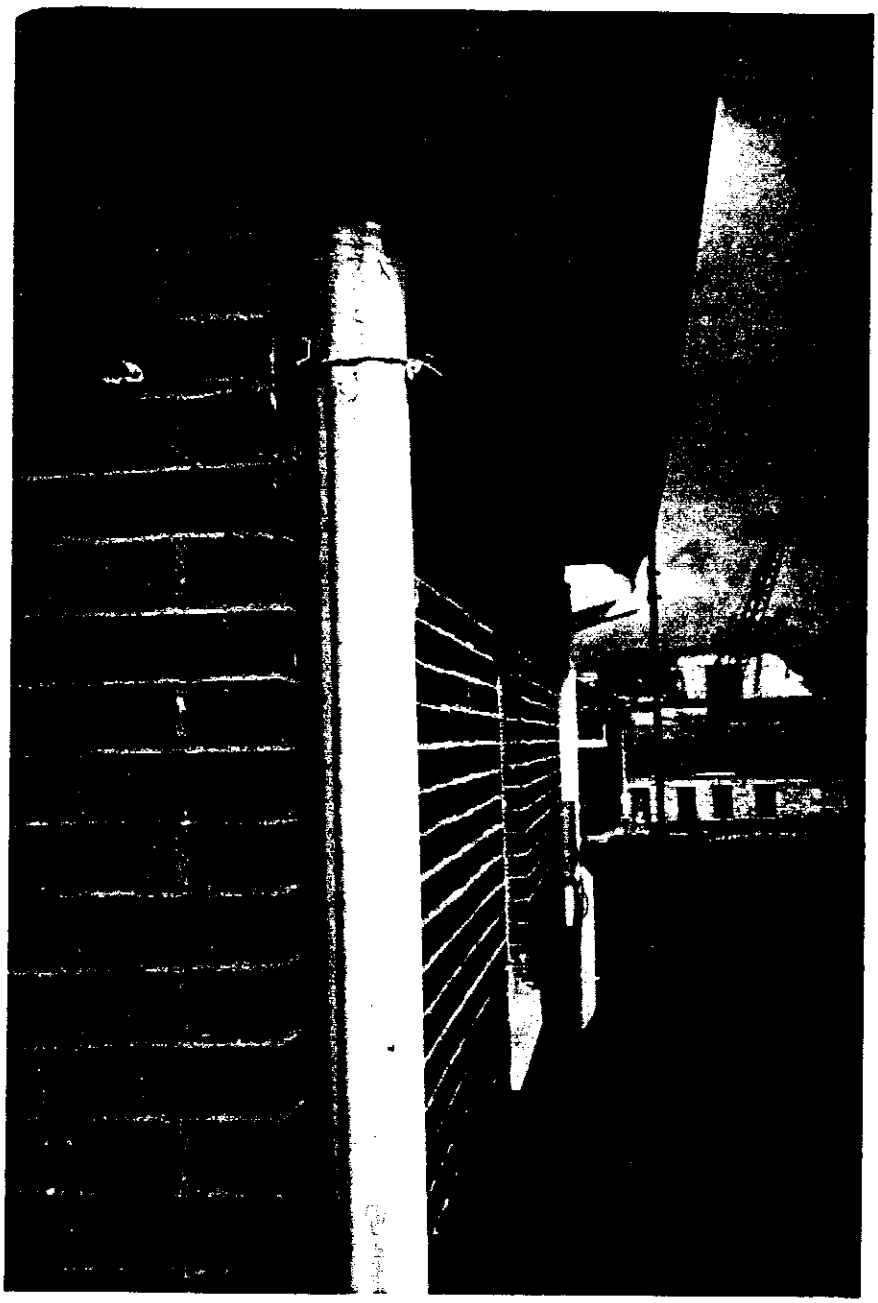


Fig. 13 INTERIOR VIEW, NORTHWEST OPERATOR'S HOUSE (Original photograph located at the Wisconsin Maritime Museum).

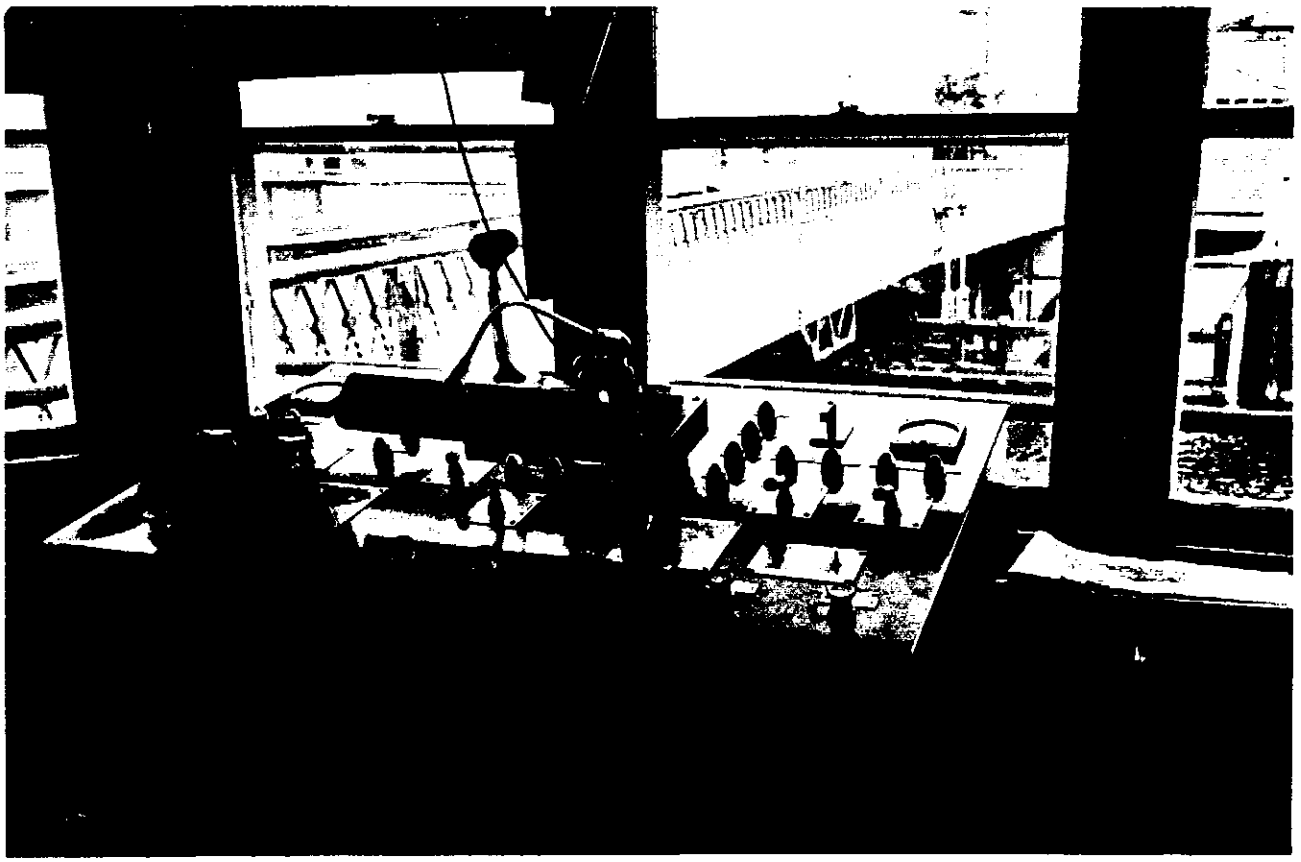


Fig. 14 UNDERSIDE OF BRIDGE, LOOKING NORTH (Original photograph located at the Wisconsin Maritime Museum).

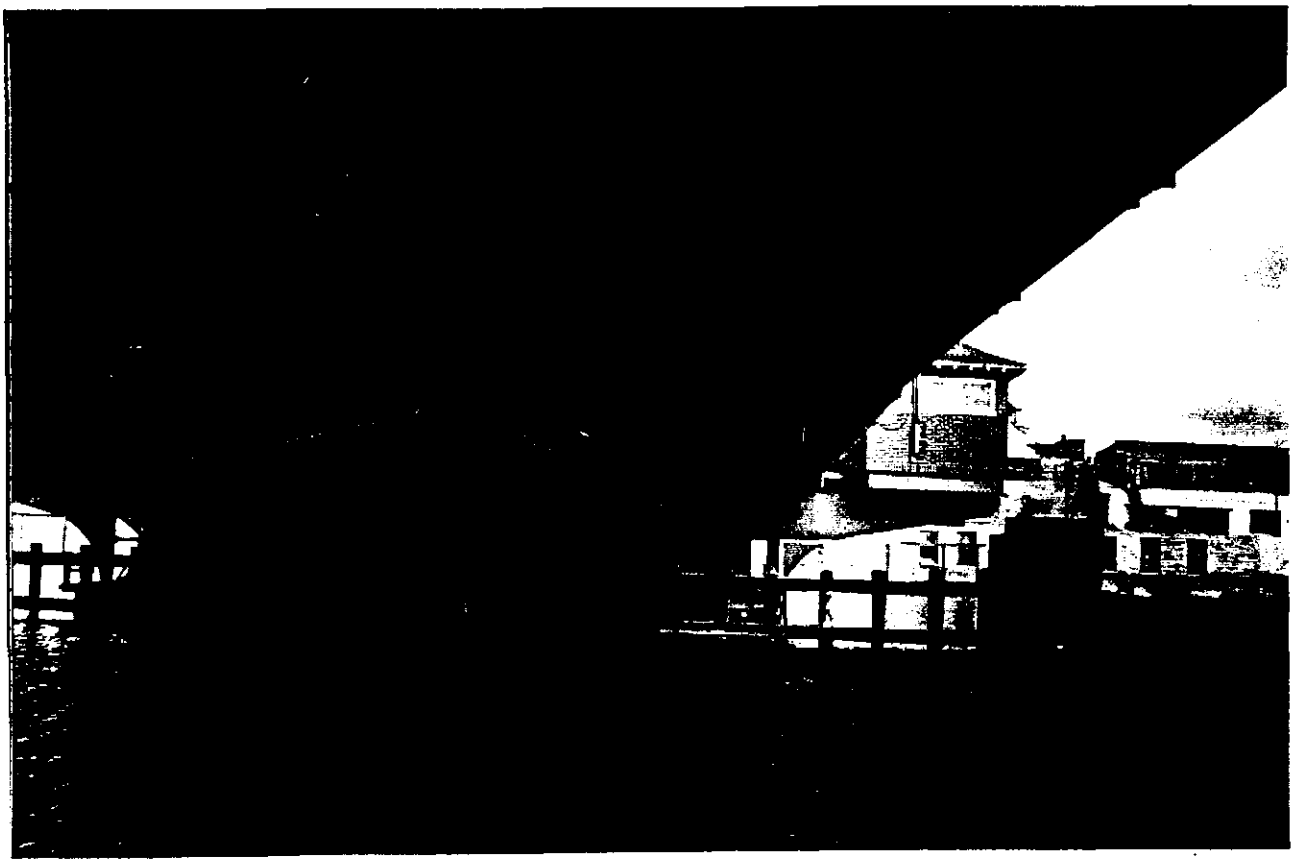


Fig. 15 INTERIOR VIEW, LOCKING MECHANISM (Original photograph located at the Wisconsin Maritime Museum).